

## TENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 08 November 2000 (08.11.00)	
<b>International application No.</b> PCT/GB00/01082	<b>Applicant's or agent's file reference</b> KWN 7250-01/H
<b>International filing date (day/month/year)</b> 23 March 2000 (23.03.00)	<b>Priority date (day/month/year)</b> 25 March 1999 (25.03.99)
<b>Applicant</b> NORTH, John, Herbert	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
22 September 2000 (22.09.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Olivia TEFY Telephone No.: (41-22) 338.83.38
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## PATENT COOPERATION TREATY

PCT

## NOTIFICATION RELATING TO PRIORITY CLAIM

(PCT Rules 26bis.1 and 26bis.2 and  
Administrative Instructions, Sections 402 and 409)

From the INTERNATIONAL BUREAU

To:

KEITH W. NASH & CO.  
90-92 Regent Street  
Cambridge CB2 1DP  
ROYAUME-UNIDate of mailing (day/month/year)  
19 July 2000 (19.07.00)Applicant's or agent's file reference  
KWN 7250-01/H

## IMPORTANT NOTIFICATION

International application No.  
PCT/GB00/01082International filing date (day/month/year)  
23 March 2000 (23.03.00)Applicant  
NORTH, John, Herbert

The applicant is hereby notified of the following in respect of the priority claim(s) made in the international application.

- 1.
- ☒
- Correction of priority claim.**
- In accordance with the applicant's notice received on: 30 May 2000 (30.05.00), the following priority claim has been corrected to read as follows:

GB 29 April 1999 (29.04.99) 9909836.0

- ☐ even though the indication of the number of the earlier application is missing.
- ☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

- 2.
- ☐
- Addition of priority claim.**
- In accordance with the applicant's notice received on: , the following priority claim has been added:

- ☐ even though the indication of the number of the earlier application is missing.
- ☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

- 3.
- ☐
- As a result of the correction and/or addition of (a) priority claim(s) under items 1 and/or 2, the (earliest) priority date is:

- 4.
- ☐
- Priority claim considered not to have been made.**

- ☐ The applicant failed to respond to the invitation under Rule 26bis.2(a) (Form PCT/IB/316) within the prescribed time limit.
- ☐ The applicant's notice was received after the expiration of the prescribed time limit under Rule 26bis.1(a).
- ☐ The applicant's notice failed to correct the priority claim so as to comply with the requirements of Rule 4.10.

The applicant may, before the technical preparations for international publication have been completed and subject to the payment of a fee, request the International Bureau to publish, together with the international application, information concerning the priority claim. See Rule 26bis.2(c) and the PCT Applicant's Guide, Volume I, Annex B2(II).

- 5.
- ☐
- In case where multiple priorities have been claimed, the above item(s) relate to the following priority claim(s):

6. A copy of this notification has been sent to the receiving Office and

- ☒ to the International Searching Authority (where the international search report has not yet been issued).
- ☒ the designated Offices (which have already been notified of the receipt of the record copy).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer

Lazar Joseph Panakal

Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.83.38

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Keith W Nash & Co  
90-92 Regent Street  
Cambridge CB2 1DP  
GRANDE BRETAGNE

## PCT

### NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Rule 71.1)

Date of mailing  
(day/month/year) 30.05.2001

Applicant's or agent's file reference  
C725.01/H

#### IMPORTANT NOTIFICATION

International application No.  
PCT/GB00/01082

International filing date (day/month/year)  
23/03/2000

Priority date (day/month/year)  
25/03/1999

Applicant  
NORTH, John Herbert

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
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Authorized officer

Marra, E

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>C725.01/H</b>	<b>FOR FURTHER ACTION</b>		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. <b>PCT/GB00/01082</b>	International filing date ( <i>day/month/year</i> ) <b>23/03/2000</b>	Priority date ( <i>day/month/year</i> ) <b>25/03/1999</b>	
International Patent Classification (IPC) or national classification and IPC <b>D06F35/00</b>			
Applicant <b>NORTH, John Herbert</b>			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
 

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1-10 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  <b>22/09/2000</b>	Date of completion of this report  <b>30.05.2001</b>
Name and mailing address of the international preliminary examining authority: <div style="display: flex; align-items: center;"> <div>             European Patent Office              D-80298 Munich              Tel. +49 89 2399 - 0 Tx: 523656 epmu d              Fax: +49 89 2399 - 4465           </div> </div>	Authorized officer  <b>Poalas, K</b>  Telephone No. +49 89 2399 2066



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/01082

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-21 as originally filed

**Claims, No.:**

1-50 as received on 14/04/2001 with letter of 10/04/2001

**Drawings, sheets:**

1/10-10/10 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01082

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

**see separate sheet**

6. Additional observations, if necessary:

## IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.  
☐ paid additional fees.  
☐ paid additional fees under protest.  
☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.  
☒ not complied with for the following reasons:  
**see separate sheet**

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.  
☒ the parts relating to claims Nos. 1-44.

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-44
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-44
	No:	Claims

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01082

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Industrial applicability (IA)    Yes:    Claims    1-44  
   No:    Claims

2. Citations and explanations  
**see separate sheet**

## **VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

## **VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

## **Ad Section IV**

The elliptical capsule disclosed in claims 1 to 44 is not mentioned in the claims 45 to 50.

Therefore, the claims are not so linked as to form a single general inventive concept (Rule 13.1 PCT).

## **Section V**

### **Claims 1 and 42**

GB 1 069 569 A describes a washing process performed in a process vessel for textile fabrics comprising a washing operation at elevated pressure.

It is the object of the present invention to provide apparatus and a method of washing articles that can be used in a shorter time-scale and with reduced energy requirements and which can be used with minor modification for dry-cleaning articles using an appropriate dry-cleaning solvent.

This object is achieved through a machine according to claim 1 and a method according to claim 42, wherein a washing operation at elevated pressure takes place in an elliptical rotatable capsule.

None of the documents of the international search report discloses such a solution.

Claims 1 and 42 therefore fulfil the requirements of Articles 33(2) and 33(3) PCT.

### **Claims 2 to 41, 43, 44**

Claims 2 to 41, 43, 44 disclosing modifications of the inventive idea embodied in claims 1 and 42, also meet the requirements of Articles 33(2) and 33(3) PCT.

## **Ad section VII**



1. Independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT.
2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
3. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document GB 1 069 569 A is not mentioned in the description, nor is this document identified therein.

### **Ad section VIII**

The unit "psi" used in the description should have been replaced by the appropriate SI unit. The present expression should have been retained in parentheses after the replacement expression.

C725.01/H

CLAIMS

1. A machine for washing and/or cleaning articles, which comprises a sealable enclosure for containing the articles to which cleaning liquid is to be supplied, characterised in that the cleaning liquid is heated to a high temperature and forced into the enclosure under high pressure as finely dispersed or diffused droplets forming a mist or vapour so that a pressure greater than atmospheric is maintained in the enclosure to force the cleaning liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the cleaning process, and wherein the enclosure is in the form of an elliptical capsule mounted for rotation about an axis through the mid-point of its longer axis, so that articles located therein will tend to fall from one end to the other as the capsule is rotated thereby to assist in the mixing of the liquids introduced into the capsule.
2. A machine as claimed in claim 1, wherein the cleaning liquid is removed from the articles and the interior of the enclosure by means of a suction pump and replaced by clean liquid for rinsing, and if desired also heated to higher than ambient temperatures.
3. A machine as claimed in claim 2, wherein the liquid supplied for rinsing is also at higher than atmospheric pressure.
4. A machine as claimed in claim 2 or 3, wherein the rinsing liquid is also heated above ambient temperature.
5. A machine as claimed in either of claims 3 or 4, wherein the rinsing liquid is removed from the enclosure by suction.

6. A machine as claimed in any of claims 1 to 5, wherein means is provided for extracting residual moisture from the articles in the form of a suction pump, wherein during a drying cycle following washing and/or a rinsing cycle suction is employed to reduce the pressure on the downstream side of the enclosure substantially below atmospheric, so that evaporative drying of moisture remaining on or in the material from which the articles are formed, occurs.
7. A machine as claimed in claim 6, wherein the vapour laden air produced by the evaporation is removed from the enclosure by the scavenging action of the air being drawn from the enclosure under the suction.
8. A machine as claimed in any of claims 1 to 7, wherein the enclosure comprises a rotatable drum, with a drive means for rotating the drum when in use and inlet and outlet means which permit relative movement to enable liquid and air to be supplied, to and drawn off therefrom, whilst the drum is rotating.
9. A machine as claimed in any of claims 1 to 7, wherein the enclosure comprises a housing within which a rotatable drum is mounted and the drum is adapted by means of openings to permit air and liquid to be forced axially and/or radially therethrough.
10. A machine as claimed in claim 9, wherein the openings comprise a large number of small apertures such as perforations in the wall of the drum.
11. A machine as claimed in claims 9 and 10, wherein the air and liquid mixture may be forced into the drum in a radial sense from the space around the drum within the housing, and be collected and conveyed away from the drum via a central porous or apertured hollow sleeve, mounted axially and centrally within the drum.
12. A machine as claimed in any of claims 9 to 11, wherein the housing forms part of the drum and rotate therewith, or is stationary so as to simplify the air and liquid supply to, and drainage from, the drum.

13. A machine as claimed in claim 1, wherein a reservoir is provided for containing a dry-cleaning fluid and valves and pumps are controlled by a computer to introduce a given value of the fluid into the under positive pressure after articles have been inserted, and the enclosure sealed to atmosphere and after rotation and thoroughly mixing the article, and the fluid, a suction pump is operated to evacuate the enclosure and remove the dry cleaning fluid and vapour therefrom.
14. A machine as claimed in any of claims 1 to 13, wherein the above atmospheric air pressure is obtained using an impeller, or turbine, or a centrifugal air pump.
15. A machine as claimed in any of claims 1 to 14, wherein the suction to produce depressed pressures below atmospheric is obtained using a venturi vacuum pump.
16. A machine as claimed in claim 15, wherein the venturi pump is a dual conical venturi jet high vacuum pump capable of generating a suction equivalent to 760mm Hg.
17. A machine as claimed in any of claims 1 to 16, wherein a filter is provided at the inlet to the enclosure and liquid is finely dispersed and/or diffused on entry into the enclosure by forcing it therethrough.
18. A machine as claimed in any of claims 1 to 17, wherein means is provided to mix the liquid with air at elevated pressure, and optionally desired elevated temperature, before being forced under pressure through the inlet filter.
19. A machine as claimed in either of claims 17 or 18, wherein the filter is a fine mesh filter.
20. A machine as claimed in claim 1, wherein the enclosure is in the form of an elliptical capsule mounted for rotation about an axis through the mid-point of the longer axis perpendicular to the latter and comprising a diameter of the cylindrical mid-region of

the capsule, so that articles located therein will tend to fall from one end to the other as the capsule is rotated and thereby assist in the mixing of the liquids introduced into the capsule during the washing or cleaning process and to agitate the articles excessively during the drying cycle to further assist in removing moisture therefrom.

21. A machine as claimed in claim 20, in which the capsule is to be loaded and unloaded through a circular opening in the front wall of a rectangular housing within which the capsule is located for rotation, and wherein the opening in the front housing wall is normally closed by a hinged circular door, the front opening (and in consequence the door also), is arranged coaxially relative to the axis of rotation of the capsule, and the capsule includes a circular opening which aligns with the circular front housing opening, and an annular seal is provided between the two openings to enable a positive pressure to be maintained in the capsule after the door has been closed.
22. A machine as claimed in claim 21, wherein a double door assembly is provided one closing an opening in the capsule wall and the other the opening in the front wall of the housing.
23. A machine as claimed in claim 22, wherein a seal is provided around each said door to seal it against the opening in the capsule wall, or the opening in the front housing wall, respectively.
24. A machine as claimed in any of claims 20 to 23, wherein valve means is provided to control the admission of liquid and air to the capsule after the openings have been sealingly closed.
25. A machine as claimed in claim 24, wherein the valve means comprises a solenoid valve.
26. A machine as claimed in any of claims 20 to 25, wherein the capsule is mounted for rotation by two rotary support bearing assemblies, one surrounding the loading and

unloading opening and the other attached to a diametrically opposite region of the cylindrical wall of the mid-region of the capsule coaxial with the first bearing assembly.

27. A machine as claimed in claim 26, wherein the second bearing assembly surrounds a circular region in the capsule wall opposite to the loading and unloading opening, and concentric pipe means having a rotary seal with the wall of the capsule, enables the capsule to rotate whilst still being connected to the liquid and air supplies and also allows liquid and air to enter the capsule whilst the latter rotates.
28. A machine as claimed in claim 27, wherein the pipe means communicates with one or more fine mesh filters to disperse and diffuse incoming high pressure liquid and air into a fine mist.
29. A machine as claimed in any of claims 24 to 28, wherein the valve means controlling the passage of liquid and air into the capsule is arranged adjacent the pipe means where it extends through the capsule wall and is attached to, or forms part, of the capsule wall.
30. A machine as claimed in claim 29, wherein the pipe means and valve is surrounded by and extends axially through a hollow cylindrical drive shaft carrying a large diameter pulley which shaft extends through a support bearing assembly at the rear of the capsule and is joined to the capsule wall, and an electric motor, whose output shaft carries a complementary pulley aligned with the first mentioned pulley, allows drive to be transmitted to the drive shaft from the motor via a drive band, to rotate the capsule about the support bearing axis.
31. A machine as claimed in claim 30, wherein the bearing assembly is a so-called split bearing and is mounted on a sub-frame within the housing.

32. A machine as claimed in any of claims 21 to 31, wherein the opposite ends of the capsule include sieve-type filters and the pipe means delivers liquid and air to the two filters to enter the interior of the capsule from opposite ends thereof.
33. A machine as claimed in any of claims 21 to 31, wherein a hollow cylindrical sleeve extends across the interior of the capsule coaxial with the aligned support bearing axes which define the axis of rotation of the capsule, and the sleeve wall is perforated with tiny apertures through which the liquid and air exit into the interior of the capsule as a fine mist diffused by the tiny perforations, which form a cylindrical fine mesh sieve type filter.
34. A machine as claimed in claim 32 or 33, wherein the fine mesh filter allows the incoming pressurized liquid and air to diffuse into the articles and produce a fast gaseous reaction inside the capsule due the liquid gaining heat energy by virtue of the liquid being forced through the plurality of tiny openings making up the filter mesh, so as to produce a sprinkler jet action for the gas-liquid mixture.
35. A machine for washing as claimed in any of claims 21 to 34, wherein a heater is provided to heat the water to boiling point so that at least part of the liquid entering the capsule is in the form of steam vapour.
36. A machine as claimed in any of claims 21 to 35, wherein the shape of the capsule ensures that articles and liquid are tumbled from one end to the other under gravity as the capsule is rotated.
37. A machine as claimed in any of claims 1 to 36, wherein the air expands due to its being heated after coming into contact with the steam so that a further increase in pressure within the capsule results causing the detergent suds to more thoroughly permeate the articles particularly where the latter are formed from woven fabric, so further assisting the release of dirt and particles causing stains and marks in the fabric.

38. A machine as claimed in any of claims 21 to 37 for washing articles, wherein access to the enclosure is via a top opening, means is provided to extract the liquid and air from the end of the capsule opposite to the end containing the sealable opening through which access can be gained to the interior of the capsule, so that the garments tend to gravitate towards the end opposite to the opening under the suction effect, and in this way the weight of the garments at that end will tend to ensure that the capsule will always come to rest with its end containing the access aperture uppermost and in alignment with an opening in the housing surrounding the capsule which in use will normally be closed by a lid.
39. A machine as claimed in any of the preceding claims 2 to 38, wherein the vacuum pump comprises a venturi tube includes a peripheral air duct, set around the outside of the venturi outlet, and this arrangement accelerates with flow, and the venturi tube is connected to a branch inlet at the mid point of a 90 degree radius bend relative to the centreline of the tube o/d to provide a strong vacuum suction, pump delivers water through the venturi supply tube, and an air blower outlet is connected via a pipe to the peripheral air chamber to control the air flow around the venturi, which in turn controls the amount of the suction.
40. A machine as claimed in claim 39, wherein an air pressure relief valve is provided which also controls the amount of suction created.
41. A machine as claimed in any of claims 21 to 40, wherein the vacuum, the temperature, and the pressure are displayed in an analogue or digital display (preferably an analogue LCD bar display) on the front of the machine housing.
42. A method of washing articles using a machine as claimed in any of claims 1 to 41, comprising the steps of:
- inserting an article or articles to be washed, into a sealable capsule,
  - sealing the capsule



- introducing a detergent solution at or around boiling point together with steam into the sealed capsule, under a pressure greater than ambient
- rotating the capsule to agitate the article(s) and effect a mixing of the liquid and steam therewith
- pumping the liquid from the capsule after a predetermined time
- introducing clean water into the capsule and further rotating same to rinse the articles
- pumping the rinsing water from the capsule after a predetermined time
- continuing to pump the capsule so as to lower the pressure therein to below atmospheric for a further predetermined period of time to assist in evaporative drying of the article(s) therein
- removing the article(s) after establishing ambient pressure in the capsule.

43. A method as claimed in claim 42, wherein the suction pumping of liquids and air is effected using a venturi suction pump.

44. A machine as claimed in any of claims 1 to 41 which includes a reservoir of a volatile cleaning fluid such as isopropyl alcohol, means for introducing the fluid into the capsule with one or more items of clothing or the like which are to be dry cleaned, means for sealing the capsule so as to provide a gas-tight compartment, means for rotating the capsule in the range 80-100rpm, prior to unsealing the capsule to remove the clothing or like articles, and suction pump means, particularly a venturi vacuum pump, for extracting vapours and gases left over from the cleaning process.

45. A machine for washing articles which comprises a sealable enclosure for containing the articles to which a mixture of detergent and water (washing liquid) is to be supplied, characterised in that the liquid is heated to a high temperature and forced into the enclosure under high pressure so as to form a two phase vapour or mist of finely dispersed or diffused droplets of liquid and steam, and a pressure greater than atmospheric is maintained in the enclosure to force the liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the washing process.

46. A machine for washing and/or cleaning articles which comprises a sealable enclosure for containing the articles to which cleaning liquid is to be supplied, characterised in that the cleaning liquid is heated to a high temperature and forced into the enclosure under high pressure as finely dispersed or diffused droplets forming a mist or vapour so that a pressure greater than atmospheric is maintained in the enclosure to force the cleaning liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the cleaning process, wherein the cleaning liquid is removed from the articles and from the interior of the enclosure by means of a suction pump.
47. A machine as claimed in claim 46 wherein the suction pump is a venturi pump and water supplied thereto under pressure by a pump (16), and after leaving the venturi pump, the water is conveyed to a sump (150) which includes a return pipe (154 for returning the water to the pump (116).
48. A method of washing articles comprising the steps of:
- inserting an article or articles to be washed into a sealable capsule,
  - sealing the capsule, and further characterised by the steps of:-
  - introducing a detergent solution at or around boiling point together with steam into the sealed capsule, under a pressure greater than ambient
  - rotating the capsule to agitate the article(s) and effect a mixing of the liquid and steam therewith
  - pumping the liquid from the capsule after a predetermined time
  - introducing clean water into the capsule and further rotating same to rinse the articles
  - pumping the rinsing water from the capsule after a predetermined time
  - continuing to pump the capsule so as to lower the pressure therein to below atmospheric for a further predetermined period of time to assist in evaporative drying of the article(s) therein, and
  - removing the article(s) after establishing ambient pressure in the capsule.

49. A method as claimed in claim 48, wherein the suction pumping of liquids and air is effected using a venturi suction pump.

50. A method as claimed in claim 48 or 49 wherein the water is mixed with detergent and the mixture is subsequently pressurised to a pressure above ambient prior to being introduced into the capsule.

REPLACED BY  
ART 34 AINDT

CLAIMS

1. In a machine for washing and/or cleaning articles and which comprises a sealable enclosure for containing the articles to which cleaning liquid is to be supplied, the cleaning liquid is heated to a high temperature and forced into the enclosure under high pressure as finely dispersed or diffused droplets forming a mist or vapour so that a pressure greater than atmospheric is maintained in the enclosure to force the cleaning liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the cleaning process.
2. In a machine as claimed in claim 1, the cleaning liquid is removed from the articles and the interior of the enclosure by means of a suction pump and replaced by clean liquid for rinsing, and if desired also heated to higher than ambient temperatures.
3. In a machine as claimed in claim 2, the liquid supplied for rinsing is also at higher than atmospheric pressure.
4. In a machine as claimed in claim 2 or 3, the rising liquid is also heated above ambient temperature.
5. In a machine as claimed in either of claims 3 or 4, the rinsing liquid is removed from the enclosure by suction.
6. In a machine as claimed in any of claims 1 to 5, means is provided for extracting residual moisture from the articles in the form of a suction pump, wherein during a drying cycle following washing and/or a rinsing cycle suction is employed to reduce the pressure on the downstream side of the enclosure substantially below atmospheric,

so that evaporative drying of moisture remaining on or in the material from which the articles are formed, occurs.

7. In a machine as claimed in claim 6, the vapour laden air produced by the evaporation is removed from the enclosure by the scavenging action of the air being drawn from the enclosure under the suction.
8. In a machine as claimed in any of claims 1 to 7, the enclosure comprises a rotatable drum, with a drive means for rotating the drum when in use and inlet and outlet means which permit relative movement to enable liquid and air to be supplied, to and drawn off therefrom, whilst the drum is rotating.
9. In a machine as claimed in any of claims 1 to 7, the enclosure comprises a housing within which a rotatable drum is mounted and the drum is adapted by means of openings to permit air and liquid to be forced axially and/or radially therethrough.
10. In a machine as claimed in claim 9, the openings comprise a large number of small apertures such as perforations in the wall of the drum.
11. In a machine as claimed in claim 9 and 10, the air and liquid mixture may be forced into the drum in a radial sense from the space around the drum within the housing, and be collected and conveyed away from the drum via a central porous or apertured hollow sleeve, mounted axially and centrally within the drum.
12. In a machine as claimed in any of claims 9 to 11, the housing forms part of the drum and rotate therewith, or is stationary so as to simplify the air and liquid supply to, and drainage from, the drum.
13. In a machine as claimed in claim 1, a reservoir is provided for containing a dry-cleaning fluid and valves and pumps are controlled by a computer to introduce a given value of the fluid into the under positive pressure after articles have been inserted, and

the enclosure sealed to atmosphere and after rotation and thoroughly mixing the article, and the fluid, a suction pump is operated to evacuate the enclosure and remove the dry cleaning fluid and vapour therefrom.

14. In a machine as claimed in any of claims 1 to 13, the above atmospheric air pressure is obtained using an impeller, or turbine, or a centrifugal air pump.
15. In a machine as claimed in any of claims 1 to 14, the suction to produce depressed pressures below atmospheric is obtained using a venturi vacuum pump.
16. In a machine as claimed in claim 15, the venturi pump is a dual conical venturi jet high vacuum pump capable of generating a suction equivalent to 760mm Hg.
17. In a machine as claimed in any of claims 1 to 16, wherein a filter is provided at the inlet to the enclosure and liquid is finely dispersed and/or diffused on entry into the enclosure by forcing it therethrough.
18. In a machine as claimed in any of claims 1 to 17, means is provided to mix the liquid with air at elevated pressure, and optionally desired elevated temperature, before being forced under pressure through the inlet filter.
19. In a machine as claimed in either of claims 17 or 18, wherein the filter is a fine mesh filter.
20. In a machine as claimed in claim 1, the enclosure is in the form of an elliptical capsule mounted for rotation about an axis through the mid-point of the longer axis perpendicular to the latter and comprising a diameter of the cylindrical mid-region of the capsule, so that articles located therein will tend to fall from one end to the other as the capsule is rotated and thereby assist in the mixing of the liquids introduced into the capsule during the washing or cleaning process and to agitate the articles excessively during the drying cycle to further assist in removing moisture therefrom.

21. In a machine as claimed in claim 20, in which the capsule is to be loaded and unloaded through a circular opening in the front wall of a rectangular housing within which the capsule is located for rotation, and wherein the opening in the front housing wall is normally closed by a hinged circular door, the front opening (and in consequence the door also), is arranged coaxially relative to the axis of rotation of the capsule, and the capsule includes a circular opening which aligns with the circular front housing opening, and an annular seal is provided between the two openings to enable a positive pressure to be maintained in the capsule after the door has been closed.
22. In a machine as claimed in claim 21, a double door assembly is provided one closing an opening in the capsule wall and the other the opening in the front wall of the housing.
23. In a machine as claimed in claim 22, a seal is provided around each said door to seal it against the opening in the capsule wall, or the opening in the front housing wall, respectively.
24. In machine as claimed in any of claims 20 to 23, valve means is provided to control the admission of liquid and air to the capsule after the openings have been sealingly closed.
25. In a machine as claimed in claim 24, the valve means comprises a solenoid valves.
26. In a machine as claimed in any of claims 20 to 25, the capsule is mounted for rotation by two rotary support bearing assemblies, one surrounding the loading and unloading opening and the other attached to a diametrically opposite region of the cylindrical wall of the mid-region of the capsule coaxial with the first bearing assembly.
27. In a machine as claimed in claim 26, the second bearing assembly surrounds a circular region in the capsule wall opposite to the loading and unloading opening, and concentric pipe means having a rotary seal with the wall of the capsule, enables the

capsule to rotate whilst still being connected to the liquid and air supplies and also allows liquid and air to enter the capsule whilst the latter rotates.

28. In a machine as claimed in claim 27, the pipe means communicates with one or more fine mesh filters to disperse and diffuse incoming high pressure liquid and air into a fine mist.
29. In a machine as claimed in any of claims 24 to 28, the valve means controlling the passage of liquid and air into the capsule is arranged adjacent the pipe means where it extends through the capsule wall and is attached to, or forms part, of the capsule wall.
30. In a machine as claimed in claim 29, the pipe means and valve is surrounded by and extends axially through a hollow cylindrical drive shaft carrying a large diameter pulley which shaft extends through a support bearing assembly at the rear of the capsule and is joined to the capsule wall, and an electric motor, whose output shaft carries a complementary pulley aligned with the first mentioned pulley, allows drive to be transmitted to the drive shaft from the motor via a drive band, to rotate the capsule about the support bearing axis.
31. In a machine as claimed in claim 30, the bearing assembly is a so-called split bearing and is mounted on a sub-frame within the housing.
32. In a machine as claimed in any of claims 21 to 31, the opposite ends of the capsule include sieve-type filters and the pipe means delivers liquid and air to the two filters to enter the interior of the capsule from opposite ends thereof.
33. In a machine as claimed in any of claims 21 to 31, a hollow cylindrical sleeve extends across the interior of the capsule coaxial with the aligned support bearing axes which define the axis of rotation of the capsule, and the sleeve wall is perforated with tiny apertures through which the liquid and air exit into the interior of the capsule as a fine



mist diffused by the tiny perforations, which form a cylindrical fine mesh sieve type filter.

34. In a machine as claimed in claim 32 or 33, the fine mesh filter allows the incoming pressurised liquid and air to diffuse into the articles and produce a fast gaseous reaction inside the capsule due the liquid gaining heat energy by virtue of the liquid being forced through the plurality of tiny openings making up the filter mesh, so as to produce a sprinkler jet action for the gas-liquid mixture.
35. In a machine for washing as claimed in any of claims 21 to 34, a heater is provided to heat the water to boiling point so that at least part of the liquid entering the capsule is in the form of steam vapour.
36. In a machine as claimed in any of claims 21 to 35, wherein the shape of the capsule ensures that articles and liquid are tumbled from one end to the other under gravity as the capsule is rotated.
37. In a machine as claimed in any of claims 1 to 36, wherein the air expands due to its being heated after coming into contact with the steam so that a further increase in pressure within the capsule results causing the detergent suds to more thoroughly permeate the articles particularly where the latter are formed from woven fabric, so further assisting the release of dirt and particles causing stains and marks in the fabric.
38. In a machine as claimed in any of claims 21 to 37 for washing articles, wherein access to the enclosure is via a top opening, means is provided to extract the liquid and air from the end of the capsule opposite to the end containing the sealable opening through which access can be gained to the interior of the capsule, so that the garments tend to gravitate towards the end opposite to the opening under the suction effect, and in this way the weight of the garments at that end will tend to ensure that the capsule will always come to rest with its end containing the access aperture uppermost and in

alignment with an opening in the housing surrounding the capsule which in use will normally be closed by a lid.

39. A machine as claimed in any of the preceding claims 2 to 38, wherein the vacuum pump comprises a venturi tube includes a peripheral air duct, set around the outside of the venturi outlet, and this arrangement accelerates with flow, and the venturi tube is connected to a branch inlet at the mid point of a 90 degree radius bend relative to the centreline of the tube o/d to provide a strong vacuum suction, pump delivers water through the venturi supply tube, and an air blower outlet is connected via a pipe to the peripheral air chamber to control the air flow around the venturi, which in turn controls the amount of the suction.
40. A machine as claimed in claim 39, wherein an air pressure relief valve is provided which also controls the amount of suction created.
41. A machine as claimed in any of claims 21 to 40, wherein the vacuum, the temperature, and the pressure are displayed in an analogue or digital display (preferably an analogue LCD bar display) on the front of the machine housing.
42. A method of washing articles using a machine as claimed in any of claims 1 to 41, comprising the steps of:
- inserting an article or articles to be washed, into a sealable capsule,
  - sealing the capsule
  - introducing a detergent solution at or around boiling point together with steam into the sealed capsule, under a pressure greater than ambient
  - rotating the capsule to agitate the article(s) and effect a mixing of the liquid and steam therewith
  - pumping the liquid from the capsule after a predetermined time
  - introducing clean water into the capsule and further rotating same to rinse the articles
  - pumping the rinsing water from the capsule after a predetermined time

- continuing to pump the capsule so as to lower the pressure therein to below atmospheric for a further predetermined period of time to assist in evaporative drying of the article(s) therein
- removing the article(s) after establishing ambient pressure in the capsule.

43. A method as claimed in claim 42, wherein the suction pumping of liquids and air is effected using a venturi suction pump.

44. A machine as claimed in any of claims 1 to 41 which includes a reservoir of a volatile cleaning fluid such as isopropyl alcohol, means for introducing the fluid into the capsule with one or more items of clothing or the like which are to be dry cleaned, means for sealing the capsule so as to provide a gas-tight compartment, means for rotating the capsule in the range 80-100rpm, prior to unsealing the capsule to remove the clothing or like articles, and suction pump means, particularly a venturi vacuum pump, for extracting vapours and gases left over from the cleaning process.

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>KWN 7250-01/H</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 01082</b>	International filing date (day/month/year) <b>23/03/2000</b>	(Earliest) Priority Date (day/month/year) <b>25/03/1999</b>
Applicant  <b>NORTH, John Herbert</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

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☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

19

☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

P 00/01082

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 D06F35/00 D06F43/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 15709 A (T. PEETERS) 1 May 1997 (1997-05-01)  the whole document ---	1-5, 8-11, 13, 42
A	GB 1 069 569 A (CONSTRUCTIEWERKHUIZEN EMILE D'HOOGE P.V.B.A.) the whole document ---	1, 14, 18, 37, 42
A	US 5 232 476 A (BAXTER INTERNATIONAL INC.) 3 August 1993 (1993-08-03)  column 6, line 42 -column 7, line 34; figures 4,5 --- -/--	1, 2, 6-10, 13, 42, 44

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

3 July 2000

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 42 36 873 A (H. FALLER) 5 May 1994 (1994-05-05)  claims; figures ---	1-5, 8-11, 13, 42
A	US 5 459 945 A (A. SHULENBERGER) 24 October 1995 (1995-10-24) abstract; figures ---	1, 6-8, 42
A	US 2 335 560 A (N. CRANE) 30 November 1943 (1943-11-30)  the whole document -----	1, 2, 12, 20, 26, 36, 42

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01082

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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GB 1069569	A		FR 1412111 A NL 6411899 A	05-01-1966 26-04-1965
US 5232476	A	03-08-1993	US 5106404 A AU 3728893 A MX 9301156 A US 5346534 A WO 9317770 A ZA 9301373 A AT 136228 T AU 634673 B AU 8613391 A BR 9106174 A CA 2067163 A DE 69118508 D DE 69118508 T DK 498877 T EP 0498877 A ES 2088017 T IE 70754 B JP 8032289 B JP 5500473 T MX 9101072 A NO 180324 B WO 9204101 A US 5192340 A US 5304253 A ZA 9107047 A	21-04-1992 05-10-1993 01-09-1993 13-09-1994 16-09-1993 23-09-1993 15-04-1996 25-02-1993 30-03-1992 16-03-1993 13-03-1992 09-05-1996 22-08-1996 06-05-1996 19-08-1992 01-08-1996 30-12-1996 29-03-1996 04-02-1993 04-05-1992 23-12-1996 19-03-1992 09-03-1993 19-04-1994 27-05-1992
DE 4236873	A	05-05-1994	NONE	
US 5459945	A	24-10-1995	NONE	
US 2335560	A	30-11-1943	NONE	

# INTERNATIONAL SEARCH REPORT

International Application No

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## A. CLASSIFICATION OF SUBJECT MATTER

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Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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A	US 5 459 945 A (A. SHULENBERGER) 24 October 1995 (1995-10-24) abstract; figures	1,6-8,42
A	US 2 335 560 A (N. CRANE) 30 November 1943 (1943-11-30)  the whole document	1,2,12, 20,26, 36,42

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information on patent family members

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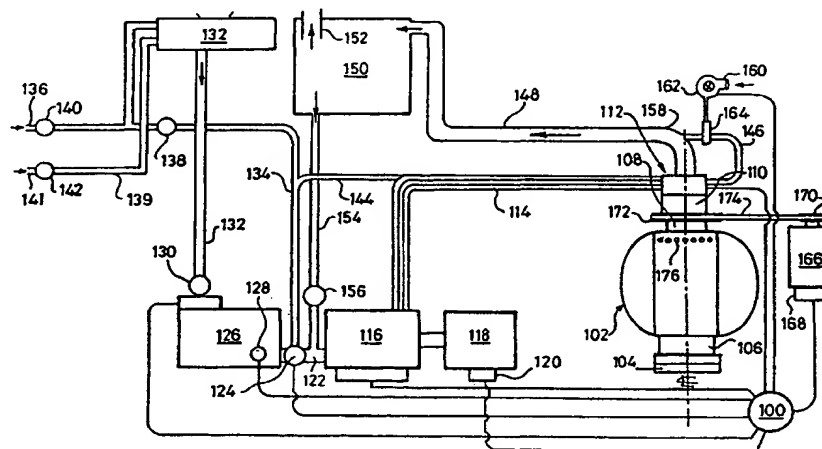
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GB 1069569 A		FR 1412111 A NL 6411899 A	05-01-1966 26-04-1965
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DE 4236873 A	05-05-1994	NONE	
US 5459945 A	24-10-1995	NONE	
US 2335560 A	30-11-1943	NONE	

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(51) International Patent Classification <sup>7</sup> : D06F 35/00, 43/00		A1	(11) International Publication Number: <b>WO 00/58544</b>
			(43) International Publication Date: 5 October 2000 (05.10.00)
(21) International Application Number: PCT/GB00/01082 (22) International Filing Date: 23 March 2000 (23.03.00) (30) Priority Data: 9906800.9      25 March 1999 (25.03.99)      GB 9907304.1      31 March 1999 (31.03.99)      GB 9909836.0      29 April 1999 (29.04.99)      GB (71)(72) Applicant and Inventor: NORTH, John, Herbert [GB/GB]; 21 Briar Court, Guardian Road, Norwich NR5 8PR (GB). (74) Agent: KEITH W. NASH & CO.; 90-92 Regent Street, Cambridge CB2 1DP (GB).		(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  Published With international search report.	

(54) Title: WASHING AND DRYING MACHINES AND DRY-CLEANING MACHINES



## (57) Abstract

A machine for washing and/or cleaning articles comprises a sealable enclosure for containing the articles to which cleaning liquid is to be supplied. The cleaning liquid is heated to a high temperature and forced into the enclosure under high pressure as finely dispersed or diffused droplets forming a mist or vapour. A pressure greater than atmospheric is maintained in the enclosure to force the cleaning liquid into at least the surface if not through and into the very structure of the material from which the articles are formed, so as to assist the cleaning process by producing a quicker and more efficient saturation of the articles by the cleaning liquid. The latter may comprise water and detergent or a dry-cleaning solvent. The cleaning liquid is removed from the articles and the interior of the enclosure by means of a suction pump. If a rinse is required, it is replaced by clean liquid for rinsing, preferably also at higher than atmospheric pressure and if desired also heated to higher than ambient temperatures. The rinsing liquid is also removed from the enclosure by suction. The suction is obtained by a suction pump typically a venturi vacuum pump and this is also employed to create a partial vacuum in the enclosure during a drying phase after the cleaning and, if desired rinsing stages.

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